Claims

1. A light device comprising:

a GaN-based layer;

a high concentration GaN-based layer formed on the GaN-based layer;

a first metal-Ga compound layer formed on the high concentration GaN-based layer;

a first metal layer formed on the first metal-Ga compound layer;

a third metal-Al compound layer formed on the first metal layer; and

a conductive oxidation preventive layer formed on the third metal-Al compound layer.

2. A light device comprising:

a GaN-based layer;

a high concentration GaN-based layer formed on the GaN-based layer;

a transparent electrode layer formed on the high concentration GaN-based layer;

a first metal-Ga compound layer formed on the transparent electrode layer;

a first metal layer formed on the first metal-Ga compound layer;

a third metal-Al compound layer formed on the first metal layer; and

a conductive oxidation preventive layer formed on the third metal-Al compound layer.

3. A light device comprising:

a GaN-based layer;

a high concentration GaN-based layer formed on the GaN-based layer;

a first metal-Ga-N compound layer formed on the high concentration GaN-based layer;

a first metal layer formed on the first metal-Ga-N compound layer;

a third metal-Al compound layer formed on the first metal layer; and

a conductive oxidation preventive layer formed on the third metal-Al compound layer.

4. The light device of any one according to claims 1 to 3, wherein the GaN-based layer is P-type or N-type.

5. The light device of any one according to claims 1 to 3, wherein the first metal layer is of one selected from the group consisting of Cr, V and W.

6. The light device of any one according to claims 1 to 3, wherein the first metal layer is of a metal or compound having a high reactivity with Ga and N.

7. The light device of any one according to claims 1 to 3, wherein the third metal is of one selected from the group consisting of Ni, Pt and Pd.

8. The light device of any one according to claims 1 to 3, wherein the third metal is of a metal or compound having a high reactivity with Al.

9. The light device of any one according to claims 1 to 3, wherein the third metal is of a metal or a compound not having a reactivity with the material forming the conductive oxidation preventive layer.

10. The light device of any one according to claims 1 to 3, wherein the conductive oxidation preventive layer is of Au, or is of a multi-metal or compound of two or more kinds containing Au.

11. A light device having a transparent electrode, wherein the transparent electrode comprises:

a metal oxide layer formed of a first metal;

a mixed oxide layer formed by reacting a third metal and a first metal forming the metal oxide layer; and

a conductive arrangement material formed of a second metal, and arranged in a metal dot shape in the metal oxide layer and the mixed oxide layer.

12. The light device according to claim 11, wherein the first metal is selected from the group consisting of Pd, Ir, Zn and Ni.

13. The light device according to claim 11, wherein the first metal is a material having a high affinity with hydrogen.

14. The light device according to claim 11, wherein the first metal is a material having a low reactivity with a P-type GaN-based layer on which an electrode is formed.

15. The light device according to claim 11, wherein the metal dot shaped conductive arrangement material functions as a conductive bridge.

16. The light device according to claim 11, wherein the second metal is Au or Pd.

17. The light device according to claim 11, wherein the third metal is selected from the group consisting of ZnO, IrO, Ir, Ni, Pd, Zn and V.

18. The light device according to claim 11, wherein the transparent electrode is formed on a sequential P-type GaN-based layer, high concentration impurity metal oxide

layer and multi-structured layer formed of the high concentration impurity metal oxide layer.

19. The light device according to claim 18, wherein the high concentration impurity metal oxide layer is of one selected from the group consisting of P^+-IrO, P^+-ZnO, and N^+-ZnO.

20. A light device comprising:

a semiconductor layer;

a high concentration impurity metal oxide layer formed on the semiconductor layer; and

a transparent electrode formed on the high concentration impurity metal oxide layer.

21. The light device according to claim 20, wherein the high concentration impurity metal oxide layer is of one selected from the group consisting of P^+-IrO, P^+-ZnO and N^+-ZnO.

22. The light device according to claim 20, wherein the transparent electrode is of one selected from the group consisting of a Ni/Au-laminated structure, a Co-O/Au-laminated structure, and a Ni-O/Au-laminated structure.

23. A light device having an electrode structure, wherein the electrode structure comprises:

a GaN-based layer;

a contact layer formed on an upper surface of the GaN-based layer and having a high reactivity with hydrogen;

a bonding pad layer formed on an upper surface of the contact layer and having a low reactivity with oxygen;

a diffusion barrier layer formed at an interface of the contact layer and the bonding pad layer; and

a high concentration GaN-based layer and a metal-hydrogen compound layer formed at an interface of the contact

layer and the GaN-based layer by a natural reaction and/or a thermal annealing process.

24. The light device according to claim 23, wherein the bonding pad layer is a single layer or a multi-layer structure of two or more layers, and is one selected from the group consisting of Gold (Au), palladium (Pd), ruthenium (Ru), nickel (Ni), tungsten (W), cobalt (Co), molybdenum (Mo) and copper (Cu).

25. The light device according to claim 23, wherein the boding pad layer is a single layer or a multi-layer structure of two or more layers, and is of one selected from the group consisting of M-O ('M' oxygen compound), M-Si ('M' silicon compound), M-N('M' nitrogen compound) and M-C ('M' carbon compound), when assuming that one element of Gold(Au), palladium (Pd), ruthenium (Ru), nickel (Ni), tungsten (W), cobalt (Co), molybdenum (Mo), copper (Cu) is 'M'.

26. The light device according to claim 23, wherein the contact layer is a single layer or a multi-layer structure of two or more layers, and is one selected from the group consisting of platinum (Pt), titanium (Ti), palladium (Pd), nickel (Ni), tantalum (Ta), tungsten (W), aluminum (Al), chrome (Cr), vanadium (V), iridium (Ir), hafnium (Hf), and cobalt (Co).

27. A light device fabrication method comprising the steps of:

forming a first metal layer on a first GaN-based layer and a second GaN-based layer;

forming a second metal layer formed of an Al-based or (Ni-Al)-based material on the first metal layer;

forming a third metal layer on the second metal layer;

forming a conductive oxidation preventive layer on the third metal layer; and

performing a thermal annealing for the resultant material of the preceding step such that upper regions of the first GaN-based layer and the second GaN-based layer are respectively formed of a high concentration first GaN-based layer and a high concentration second GaN-based layer,

a first metal-Ga compound layer is formed on the high concentration first GaN-based layer, and a first metal-Ga-N compound layer is formed on the high concentration second GaN-based layer,

a first metal layer is formed on the first metal-Ga compound layer and the first metal-Ga-N compound layer,

a third metal-Al compound layer is formed on the first metal layer, and

a conductive oxidation preventive layer is formed on the third metal-Al compound layer.

28. The fabrication method according to claim 27, wherein the first metal layer is of one selected from the group consisting of Cr, V and W.

29. The fabrication method according to claim 27, wherein the first metal layer is of a metal or compound having a high reactivity with Ga and N.

30. The fabrication method according to claim 27, wherein the third metal layer is of one selected from the group consisting of Ni, Pt and Pd.

31. The fabrication method according to claim 27, wherein a material forming the third metal layer is of a metal or compound having a high reactivity with Al.

32. The fabrication method according to claim 27, wherein the third metal layer is of a metal or compound not having a reactivity with a material forming the conductive oxidation preventive layer.

33. The fabrication method according to claim 27, wherein the conductive oxidation preventive layer is of Au, or is of a multi-metal or compound of two or more kinds containing Au.

34. The fabrication method according to claim 27, wherein in the step of forming the first metal layer on the first GaN-based layer, a first transparent electrode layer is further formed on the first GaN-based layer, and the first metal layer is formed on the first transparent electrode layer.

35. A light device fabrication method comprising the steps of:

forming a first metal layer on a GaN-based layer;

forming a second metal layer on the first metal layer;

forming a third metal layer on the second metal layer; and

performing a thermal annealing for the resultant material of the preceding step in an oxygen-containing atmosphere such that an upper region of the GaN-based layer is of a high concentration GaN-based layer,

the first metal layer is of a metallic oxide layer,

the third metal layer reacts with a first metal forming the first metal layer to form a mixed oxide layer,

the second metal layer is of a metal dot shaped conductive arrangement material within the metallic oxide layer and the mixed oxide layer.

36. The fabrication method according to claim 35, wherein the GaN-based layer is a P-type GaN layer.

37. The fabrication method according to claim 35, wherein the first metal layer is of one selected from the group consisting of Pd, Ir, Zn and Ni.

38. The fabrication method according to claim 35, wherein the first metal layer is of a material having a high affinity with hydrogen.

39. The fabrication method according to claim 35, wherein the first metal layer is of a material having a low reactivity with the GaN-based layer.

40. The fabrication method according to claim 35, wherein in the step of performing the thermal annealing for the resultant material, the first metal layer absorbs hydrogen from the GaN-based layer for reaction, and an upper portion of the GaN-based layer is of a high concentration GaN-based layer.

41. The fabrication method according to claim 35, wherein the metal dot shaped conductive arrangement material functions as a conductive bridge.

42. The fabrication method according to claim 35, wherein the second metal layer is of Au or Pt.

43. The fabrication method according to claim 35, wherein the third metal layer is of one selected from the group consisting of ZnO, IrO, Ir, Ni, Pd and V.

44. A light device fabrication method comprising the steps of:

removing a native oxide layer of a GaN-based compound semiconductor;

depositing a contact layer using a metal having an excellent reactivity with hydrogen;

forming a bonding pad layer using a metal having a low reactivity with oxygen and forming a stable compound with the contact layer; and

performing a thermal annealing.

45. The fabrication method according to claim 44, wherein the native oxide layer removing step is performed by BOE (Buffered Oxide Etch).

46. The fabrication method according to claim 44, wherein the native oxide layer removing step is performed by an etchant containing F, Cl, S and OH.

47. The fabrication method according to claim 44, wherein the bonding pad layer is a single layer or a multi-layer structure of two or more layers, and is of Gold (Au), palladium (Pd), ruthenium (Ru), nickel (Ni), tungsten (W), cobalt (Co), molybdenum (Mo), copper (Cu).

48. The fabrication method according to claim 44, wherein the boding pad layer is a single layer or a multi-layer structure of two or more layers, and is of one selected from the group consisting of M-O ('M' oxygen compound), M-Si ('M' silicon compound), M-N ('M' nitrogen compound), and M-C ('M' carbon compound), when assuming that one element of Gold(Au), palladium (Pd), ruthenium (Ru), nickel (Ni), tungsten (W), cobalt (Co), molybdenum (Mo), copper (Cu) is 'M'.

49. The fabrication method according to claim 44, wherein the contact layer is a single layer or a multi-layer structure of two or more layers, and is of one selected from the group consisting of platinum (Pt), titanium (Ti), palladium (Pd), nickel (Ni), tantalum (Ta), tungsten (W), aluminum (Al), chrome (Cr), vanadium (V), iridium (Ir), hafnium (Hf), and cobalt (Co).

50. The fabrication method according to claim 44, wherein by the contact layer depositing step, a high

concentration GaN-based layer and a metal-hydrogen compound layer are formed.

51. The fabrication method according to claim 44, wherein by the thermal annealing performing step, a diffusion barrier layer caused by a compound of two metals is formed at an interface of the contact layer and the bonding pad layer.

52. The fabrication method according to claim 44, wherein by the thermal annealing performing step, a high concentration GaN-based layer and a metal-hydrogen compound layer both of which are generated through the contact layer depositing step are formed more deeply.